EXHIBIT A

Epic r patent disclosure [redacted]

Title: Photodynamic cardiac ablation therapy

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Summary of the invention:

Current ablation techniques often use heat to create a lesion in cardiac tissue. The heat typically is generated by RF current, ultrasound, laser or microwaves. The generation of heat has the potential to damage non-target tissues, and can cause blood coagulation that sometimes results in embolic events which is particularly dangerous when ablating cardiac tissue on the left side of the heart. This invention uses a combination of a systemic drug and the application of light to create a lesion in the cardiac tissue without using heat.

A photodynamic drug is a photosensitizer that absorbs light over a range of frequencies and produces a chemical reaction. For many photosensitizers the wavelength of light used can be in the range of 405 to 630 nm. The photodynamic effect is stronger at shorter wavelengths, but longer wavelengths penetrate tissue more effectively, so light near 630 nm is preferred. The light may be from a white light source (e.g. a xenon lamp) or from a laser (preferably an argon dye laser), or from LEDs. When the light is absorbed by a photosensitizer , it produces an unstable energy state that ultimately results in the generation of an excited singlet oxygen. This reacts with other molecules in a highly energetic fashion resulting in tissue damage.

In the invention, a patient is given the photodynamic drug prior to the ablation procedure. During the procedure, a catheter or other device containing a light source, or light guides (typically fiber optics) connected to a light source, is placed on the heart in the area that the physician wants to create a lesion. The heart is then illuminated with high intensity light, triggering the photodynamic reaction in the localized area where the lesion is desired. The lesion is created without the generation of heat, and the light is shielded from non-target tissues. As a result the ablation procedure is safer than current techniques.

One drawback of radio frequency ablation is that it primarily heats the surface under the current carrying electrode. It is not possible to create deep lesions from the epicardium under vessels without damaging them. The use of photodynamic ablation techniques allow deep lesions to be created from the epicardium without damaging delicate surface surface vessels.

Other devices (Cardiofocus patent) have disclosed the use of laser energy to ablate tissue - which is basically a thermal ablation mechanism. Although the subject invention uses light it differs significantly from the prior art in that the inventive ablation technique uses photoactive chemical means to ablate tissue rather than thermal means.

Detailed description:

Pursuant to this invention which uses photodynamic therapy as a means to create lesions in the heart, the patient is intravenously injected with a dose of a photodynamic drug. The drug remains inactive until it is activated by a light source. Photodynamic drugs are available for medical uses, primarily to treat cancer. Some photosensitizing drugs and their sources are as follows:

- BOPP (boronated porphyrin) from Pacific Pharmaceutical
- FOSCAN from Scotia QuantaNova
- PHOTOFRIN (dihematoporphyrin ether also known as DHE) from QLT PhotoTherapeutic
- ANTRIN from Pharmacyclic

This invention pertains to any use of a photosensitizing drug used in combination with a device to deliver light to the heart to create a lesion, primarily to control or abolish cardiac arrhythmias of any sort. ~~As with any medical procedure using~~ If the ~~a~~ photosensitizer is given systemically, the patient must avoid direct sunlight for ~~about 4-6 weeks~~ a period of time after a photosensitizer is used to create cardiac lesions. To

avoid this side effect, the photosensitizer may be applied topically or locally to the area of the heart which is to be ablated. This may be done using a separate device from the light delivert device, or in the preferred embodiment, the photosensitizer is incorporated in the light delivery device (detailed embodiment to follow).

In one embodiment, the primary arrhythmia to be cured is atrial fibrillation. Figure 1 (maze procedure diagram) shows the lesions created by a surgeon using a scalpel to do a Maze procedure to treat atrial fibrillation (Cox reference). In the first embodiment, the subject invention is used to create all or a subset of the Maze procedure lesions using light and a photosensitizing drug instead of a knife.

Figure 2 shows a device to deliver light from a light source to the epicardium of the heart. A proximal port (10) on the device interfaces with a port (30) on an external light source (20). The light source (20) can be a xenon lamp, a high intensity LED source, laser, or any other source capable of producing illumination in the band of wavelengths from 350 to 700 nanometers. Fiber optics or other light guides (12) run inside a flexible housing (14) typically made of a polymetric material, to carry the light from the port (10) to the distal end of the device. At the distal end, the fiber optics terminate in an elongated window that allows the light to escape. The back side of the window (18) is opaque to ensure that no light escapes to reach tissues other than those targeted by the physician. To modify the area of tissue that is illuminated, the window (16) can be manufactured in different sizes, or may be shuttered by the application of an opaque adhesive tape (19) or other material. In the alternative, the proximal ends of the fiber optics (12), available at the proximal connector (10), may selectively be blocked from the light source (30) to cause less of the window (16) to be illuminated.

Figure 3 shows a device that contains light emitting devices that can deliver light to the epicardium of the heart. The proximal connector (40) is adapted to connect the light emitting devices (46) through electrical conductors (42). The light emitting devices (46) are preferably light emitting diodes (LEDs) that emit light around 600 nanometers which penetrates tissue well. The back side of the device (48) is opaque to assure that only tissues that are targeted for ablation receive light.

The devices of Figures 2 and 3 may be used by a surgeon under direct visualization in open chest procedures, or they may be introduced into the pericardial space using minimally invasive surgical procedures such as those disclosed in patent #? (Heartport/Epicor patent).

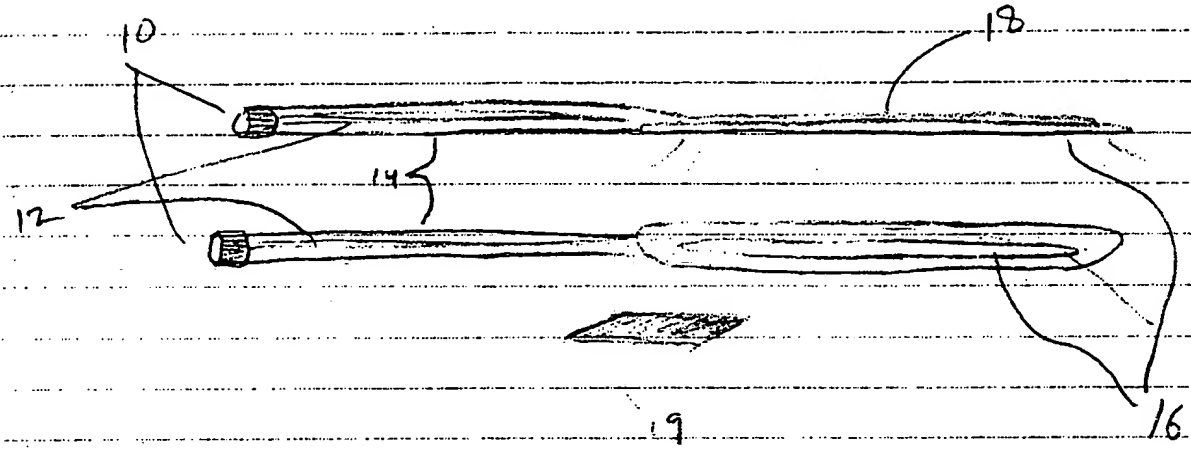
To control atrial fibrillation, the most important lesion to create is a lesion that encircles the pulmonary vein bed. Figure 4 shows the device of either Figure 2 or Figure 3 in position around the pulmonary vein bed. Figure 5 shows the device of figure 2 or 3 on the surface of the heart positioned to create a lesion from the PV encircling lesion to the mitral valve annulus.

For some cardiac procedures, a device that can deliver light to the inside of the heart (endocardially) is preferred. Figure 6 shows a catheter based device adapted to introduce light into the heart to activate a photosensitizing drug. The proximal connector (60) is adapted to connect to an external light source (20). Fiber optics or other light guides (68) carry the light through the flexible catheter body (64) to the distal window (66). The back side of the window (68) is opaque to assure that only tissues that are intended for ablation receive light.

Items to be claimed:

1. The basic concept of a light and drug combination for creating lesions in the heart.
2. The use of epicardial light delivery systems.
3. The use of endocardial light delivery systems.
4. The use of systemic photosensitizers for the procedure
5. The use of topically or locally applied photosensitizers for the procedure.
6. The use of double balloon systems with saline for the interior of the PVs.

Figure 2



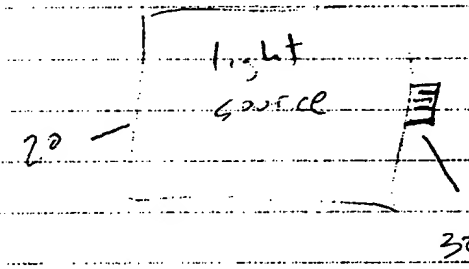


Figure 3

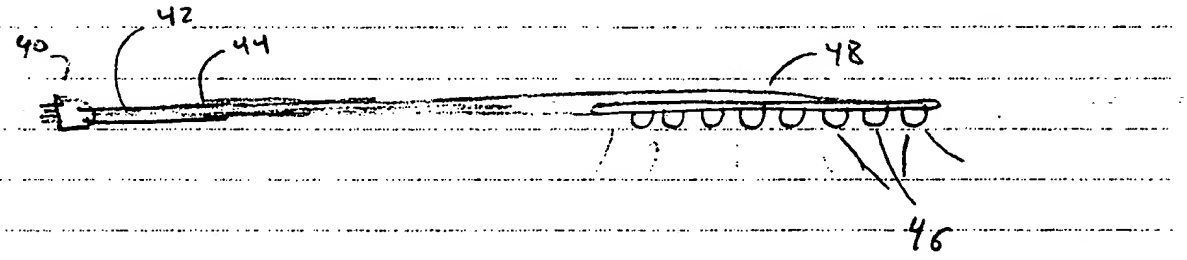


Figure 6